

THE NESTING HABITS OF THE BAYA (*PLOCEUS PHILIPPINUS*).

A NEW INTERPRETATION OF THEIR DOMESTIC RELATIONS.

BY

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(With 7 plates and 11 figures in the text.)

Having had exceptional and uninterrupted opportunities for studying the Baya this nesting season (1930), I have endeavoured to tackle some of the much-debated points in connection with the breeding habits of this interesting little bird. To my mind, my observations have not only dispelled all doubt as regards the origin and significance of the so-called 'Cocks' Nests', but have also thrown some light on the hitherto unsuspected and remarkable relationship between the sexes.

Bayas are common in the Alibag Taluka of the Kolaba District, about fifteen miles from Bombay down the coast. Out of the breeding season they go about in flocks often numbering upwards of a hundred birds. Small parties are commonly met with on Coral trees (*Erythrina indica*) immediately after the blooms have withered, and, though I have not examined the stomach contents of birds feeding on these trees, as far as could be ascertained from careful observation through field-glasses, they appeared to feed on the tender newly formed pods.

By the middle of May, some of the males had already acquired full breeding plumage, while a great many were in a transitional stage. At this time small flocks were constantly seen frequenting the interior of dense bushes during the heat of the day, indulging in choruses of *chit-chit-chit*, *chee-ee-ee*, so familiar while the birds are engaged in nest-building.

The earliest date on which a company of cocks—all in full breeding dress—were noted busy building was May 22. On July 30, I came upon a small flock comprising about five cocks in full breeding plumage and an equal number of what appeared to be females, feeding on an out-of-the-way cart track. I got five specimens in one shot; dissection proved that these were all males. Two were in breeding plumage with testes about the size of small peas. The other three had their colouration somewhat richer and brighter than females, and besides, had a slightly golden tinge on the forehead: Their organs were undeveloped and no bigger than pin-heads. These birds were probably in their first year.

On August 19, by which date nesting appeared to be in full swing everywhere, I discovered a colony (No. 1) building on a Babool tree (*Acacia* sp.) standing isolated in the centre of a tank formed in a depression in the midst of paddy cultivation. This appeared a suitable spot for observations as it was close enough to my bungalow

to allow frequent access, and yet sufficiently out of the way for village lads not to disturb the birds or tamper with my arrangements. I had a step-ladder rigged up, about eight feet high with a small platform at the top, just large enough to accommodate one person sitting on a stool. Around the platform were fixed upright palm leaves so as to form a kind of 'hide'. This step-ladder-hide was placed in the tank in knee-deep water opposite the colony, at a distance of ten to fifteen feet from the nests, and ever since and up to the time when all the young had left the nests I spent from half to three hours at a time in it almost every second or third day. The platform brought me more or less on a level with the nests, and I was enabled to observe and photograph the birds at work at close range and under comfortable and perfectly normal conditions. On the first appearance of the 'hide' the birds seemed rather alarmed, but as it was left standing there, day in and day out, they soon became used to it and grew indifferent to its presence even when occupied.

I give below the results of my observations which extended over several months. These are based on notes in my field diary relating not only to the colony which I have designated No. 1, but also to numerous others which were under regular observation throughout the period with the aid of powerful field-glasses. My notes, relative extracts from which I append, were all made either on the spot or soon after my return from the vigil. Only in a few instances I have had to elaborate them somewhat, so as to be intelligible to the reader.

Site.—It is difficult to determine what are the exact factors that govern the selection of the site for a nesting colony. When there are a number of trees standing close to one another in almost identical situations, and apparently—from human considerations—all equally suitable, what makes the birds single out just one particular individual, and then perhaps there may not be another colony within a radius of half a mile or more?

The trees most favoured in these parts (Alibag Taluka) are Babool (*Acacia* sp.), Ber (*Zizyphus* sp.), Palmyra Palm (*Borassus flabellifer*), Tamarind (*Tamarindus indica*), and Coral (*Erythrina indica*). The first three are certainly the most patronized, while in my experience, *Erythrina* is resorted to exclusively by young cocks building late in the season. Besides these, I have only once seen a single nest on a Casuarina (*C. equestifolia*). The same tree may be used for two or several successive seasons, but as regards the same nest being used more than once, I have no experience. Hume mentions¹ that 'the same nests are at times used during the second season.' From what he writes, however, it would in any case appear that this is only in exceptional or very rare cases. In the only instance that came under my notice where an old site was being used—Colony No. 1—all the old nests were pulled down by the birds either before commencing or simultaneously with the building of new ones, although some of the old nests appeared in fairly good condition. One thing is certain that the birds invariably

¹ 'Nests and Eggs of Indian Birds', Vol. ii, p. 117,



1. My Observation ' Hide ' in position at Colony No. 1.



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2. A ' Close up ' of a portion of above Colony.

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select the eastern side of the tree to build upon, which is protected from the South-West Monsoon. I have found this to hold good in the case of every colony that has come under my observation so far, either in this or previous seasons, except one which consisted of one completed and two half-built nests facing in the opposite direction. It may be mentioned, however, that these latter were built unusually late in the season—about the end of September—when the severest part of the Monsoon was over.

The nests are often suspended from branches overhanging water. It is difficult to imagine what advantage the bird derives from this habit. Where the selected tree is isolated and stands like an island in water, one can understand the nests being more or less protected against rats and other terrestrial animals. But before being able to say anything on this point, it is first and foremost necessary to ascertain who are the natural enemies of the Baya. On this matter, I have no direct evidence though my notes (September 25) show that in Colony No. 2 all the nests had been torn open near the egg-chamber and deserted. The Palmyra palm on which they hung stood on a bund between two paddy fields, and the destruction in this case may possibly be the work of a rat or some other terrestrial animal. On the other hand, I have noted (October 3) the agitated behaviour of the members of Control Colony (for a description of this, see Appendix, 'September 26'), when a Crow Pheasant (*Centropus sinensis*) appeared in the proximity of the tree, while they remained indifferent to the presence of a pair of Koels (*Eudynamis scolopaceus*), who are also destructive to the eggs of small birds, but only in open nests as far as I am aware. I have seen a Crow Pheasant tear open a nest of a Sunbird (*Leptocoma zeylonica*) and suck the eggs, and it may be permissible to accept the perturbation of the Bayas in this instance as circumstantial evidence of its doing the same with Baya nests, given the opportunity. On another occasion (October 13) I have noted a Shikra (*Astur badius*) making an unsuccessful stoop on Colony No. 1. If then, the chief enemies of the Baya are winged, what is the advantage of suspending the nests over water?

Now as regards mammals. The suggestion by Mr. Horne¹ that the newly-built nests he observed on the ground under the tree was the work of squirrels for use of the material in their own nests, is I think, untenable. In the country where I have so far had opportunities of observing the Baya, I have never come across a squirrel's nest built of the same material as a Baya's. Moreover, I continually found nests in all stages of construction floating under the tree at Colony No. 1 which stood in knee-deep water, which was decidedly not the work of any but the cocks themselves, as has also been observed by Spennemann with *Ploceus manyar* in Semarang.² I watched several from time to time, snipping off the suspensions deliberately, fluttering their wings and joining in the choruses as they did so. The work of undoing was treated in the nature of serious occupation on a par with the building. The reason for this

¹ 'Nests and Eggs', Vol. ii, p. 118.

² Aug. Spennemann, "Iets over *Ploceus manyar*" De Tropische Natuur 1926, pp. 186—189.

destruction was impossible to guess. There may as has been suggested, be some defect in the construction with which the builder or the inspecting female was dissatisfied, but on the other hand I have found a completed nest lying on the water which contained two fresh eggs (September 18). This latter I suspect to be the work of some disgruntled rival.

To continue with Mr. Horne's suggestion. To my mind the only other motive for the squirrel in snipping off the nests could be to get at the eggs, and Mr. Horne himself mentions that 'some of them had unbroken eggs in them.' Thus apparently, his squirrels derived no profit from destroying the nests!

We have, therefore, still to discover the natural enemies of the Baya in order to understand the significance, if any existing, of the habit so commonly observed, of building over water.

Material used and plan of structure.—The material used in the country where I have had opportunities of studying the Baya has been either strips of date leaves or of coarse grass. The colonies that came under my observation this season used strips of the rice plant exclusively. The method of tearing the strips and handling them is both ingenious and interesting. The paddy leaf has a saw edge and is furnished with minute upwardly-directed spines on the several ridge-like, almost parallel, veins. The leaf, therefore, can be pulled through forefinger and thumb only if pulled at *b* (see figure 1). The saw edge and spines do not allow its being pulled in the opposite direction. When tearing off the strips, the Baya makes an indentation on the edge at *b*, about 12" below the tip *a*, of the required thickness, and by a sideways

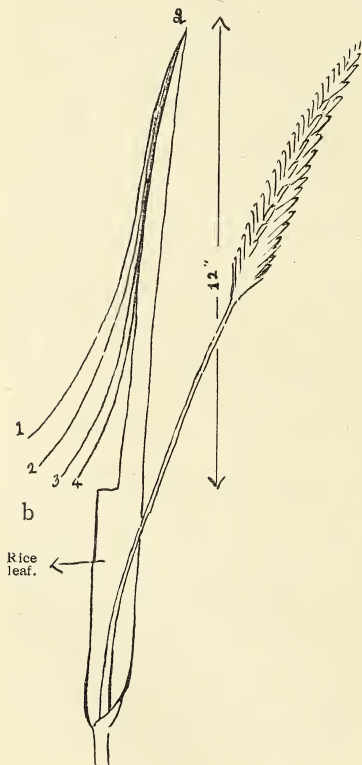


FIG. 1.

upwards towards *a*, but not severing it completely at the tip. It now

bites through another thickness at *b*, still holding the first undetached strip in its beak, and repeats the operation till it has two strips, but still connected at *a*; it collects a third and often a fourth in the same manner. The bird now flies off, and the pull so exerted, severs the bunch of strips from the leaf at the tip *a*, which trails through the air after the bird. The final jerk often also severs some of the other strips at *a*, which then stream behind the bird as so many individual strips. When the Baya arrives at the nest, therefore, he is gripping the strips in his beak at *b*. He presses the bunch roughly into site. The serrated edge and spines prevent the strips from slipping and falling down. *b* is the only possible working end, and this the bird threads through and pulls out, the roughness operating like the teeth of a ratchet and maintaining the strips in position once they have been properly pulled in. The strip is held down by a foot while the end *b* is being woven in. I have been able to watch this process time and again from beginning to end.

When commencing a nest, the strands are wound and twisted round and round the selected twig until a firm support is secured. From this depends a mass of strips, something like a tassel, which is worked into a transverse loop. This loop invariably forms the skeleton of the structure. Porches are built over the upper part on either side, one developing and broadening out later into the egg-chamber, and the other which is not so bulgy, produced into the entrance tube. Most of the former observers, with the only exception, as far as I know, of Whistler,¹ have laid stress on the fact that the loop is put in at a later stage in the construction, after the nest has assumed the shape of a 'Bell', for the convenience of the hen to perch upon while working on the interior. This is not borne out by facts.

As regards the mud employed in the nests, the purpose of this appears to be obscure. It has been suggested that it is put in to give a correct balance to the nest, and prevent it from swaying violently in the breeze. Jerdon mentions that in one case, which has since become almost classical, he found 3 oz. of mud; this must indeed be exceptional. Of the numerous nests examined by me—certainly over fifty—all contained between 0.5 and 1 oz. The quantity in one seemed unusually large, but when weighed was found to be only 1.4 oz. Considering the normal quantity usually seen, one can hardly imagine it to produce any appreciable difference in steadying the nest in the strong winds which are prevalent during the breeding season of the Baya. Then again, there are some nests in the same colony which have no mud in them at all, and seem to fare none the worse for its absence (see Appendix, 'September 29'). The *Oropendolas* (*Zarhynchus wagleri*), one of the *Icteridæ* or Hangnests of tropical America which also build woven pendant nests on high trees exposed to violent trade-winds, apparently do not employ any mud for steadying their nests.² The purpose of the mud is certainly

¹ H. Whistler. '*Birds Notes*'. Vol. V, p. 340. 1914.

² F. M. Chapman, '*The Oropendolas of Laboratory Hill*' (Barro Colorado-Panama) '*My Tropical Air Castle*—D. Appleton & Co., 1930).

not to fix fireflies on! I think it is time, however wide-spread and romantic the belief may be, that this story was once and for all put to rest. The mud is stuck into the nest chiefly at the early 'Bell' stage when it remains unoccupied at night (September 27 and 30). If fireflies were really stuck in, it would be only possible to do so at this stage when the mud is still soft. Immediately the mud hardens, the fireflies would perish, thus automatically nullifying the object for which they are alleged to be put in since dead fireflies do not emit any light. Moreover, all the evidence—if indeed it can be called evidence—we have on this point is not only unconvincing but highly questionable.¹ The only explanation one can suggest is that the habit of sticking mud in the nests is a form of atavism—the relic of some ancient custom at one time beneficial to the species. A study of allied forms, their evolution and development may throw some light on this point.

Share of the sexes in nest-building, and sexual relations.—Dr. Jerdon suggests² that upto the time the cross-bar or loop is put into the nest, both birds have worked indiscriminately, but that 'when this loop is completed, the female takes up her seat on it, leaving the cock bird to fetch more fibre and work from the outside of the nest while she works on the inside . . .' Hume endorses this description, and the versions of a great many subsequent writers support the idea of co-operation between male and female from the commencement of building operations.³ My own observations, however, tell an entirely different story. The interpretation I have put on the sexual life of the Baya with which nest-building is inextricably interwoven, is, as far as I am aware, perfectly new. Before offering it, I have thoroughly tested my facts on all sides as far as lay within my power, and found them to be sound and unassailable, and I feel confident that further independent and continuous observation in the field will confirm my conclusions. I can hardly think of another species of bird whose domestic relations are known to be so bizarre and fascinating except the Oropendolas (*Zarhynchus wagleri*) of tropical South America whose nesting habits are so graphically described by Frank M. Chapman.⁴ I gladly acknowledge that it was a perusal of this admirable essay that helped me to overcome my diffidence and to set down on paper what I have suspected to be the case for some time.

Both site-selection and nest-building are done exclusively by the cocks. The adult cocks in full breeding plumage are the earliest to begin, and always keep to colonies of their own. Never has a

¹ See D. Dewar, 'The Nesting Habits of the Baya', *Jour. B.N.H.S.*, Vol. xix, pp. 627-627.

² 'Nests and Eggs', Vol. ii, p. 115.

³ Dr. E. Stresemann has since drawn my attention to p. 344 of his excellent manual ('Handbuch der Zoologie-Aves'—Walter de Gruyter & Co., Berlin, 1928) where, on the authority of C. A. Wood ('The Nest of the Baya Weaver Bird,' *Auk* 1926, pp. 295-304), and Karl Russ ('Die Webervögel and Widafinken', Magdeburg 1879), he states that the external construction of the nest in this species is carried out exclusively by the male, and that the female only does the internal lining.

⁴ F. M. Chapman—'My Tropical Air Castle'—D. Appleton & Co., 1930.



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3. A Cock on Nest in an early stage (Note the transverse loop which invariably forms the skelton, being developed).



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4. A further stage in the construction.

young cock been observed by me building in company with adults. Young cocks generally take to nest-building late in the season, and likewise have their own separate colonies. Obviously they work without previous training or experience, and just as to the manner born, but seem to lack the requisite earnestness and purpose. In consequence of this a great many—in my experience, certainly *all*—such juvenile nests are never completed, and they are not infrequently of the queerest shapes and most ‘unprofessional’ appearance. (See Appendix, ‘September 25, 26, 27 and 29’).

At first I took these young working cocks to be females, but dissection always proved them to be otherwise. Their testes were fairly developed—about the size of small peas—and on closer examination, some of them also showed a tinge of golden yellow on forehead, crown and upper back. It is not unlikely therefore, that some of these young cocks of the first year (?) *may* breed though personally I have never come across such an instance. When at work, they indulge in the same sort of chirruping choruses and fluttering of wings as the adults do. I have never heard a female ‘singing’.

In the initial stages of an adult nesting colony, no hens are as a rule in evidence, and I have been unable to discover their whereabouts during the first few days. It would appear that the instinct to breed, asserts itself earlier in the adult cocks than in the hens, for it is not until the time when the nests have progressed to a stage where the egg-chamber is finished or nearly so, that some of the females first become physiologically ‘ripe’. They now visit the colony quite obviously with the sole object of ‘prospecting’ for laying sites, i.e., to discover if there are any nests that are ready for their occupation. The arrival of the hens at the colony causes a great stir in the community of working cocks, who leave their work and strut about after the hens, pressing their attentions upon them with such impetuosity as often to cause them to retire from the tree. The hens, however, soon return and deliberately visit nest after nest, entering them and sitting on the cross-bar in the absence of the owners who have gone to fetch material. The cock whose nest is furthest advanced, is presumably also the readiest to breed. If a hen is satisfied with a particular nest, she sets about establishing herself in possession. She persists in returning to it again and again on being strutted and chased after by the cock, who gradually gets used to her presence and finally accepts her as his legitimate spouse. Two hens often fight for the possession of an acceptable nest. The successful hen henceforward boldly enters the nest and busies herself with finishing off and making the interior comfortable. In no case have I been able to observe the co-operation between male and female so often described. The lion’s share of the building—in fact *all* of it—is undoubtedly done by the cock alone. Her contribution is only the ‘interior decoration’. I have never seen a female fetch a single strip of grass, though she may occasionally bring a feather or some vegetable down which is incorporated into the bottom of the egg-chamber. On one occasion I have also seen her bringing a pellet of mud into a completed nest. The hen enters the egg-chamber, and from the movements of the nest while she is within, it becomes apparent that she is pulling and tugging the

strips and finishing off the interior. Shortly after occupation, the eggs are laid.

Apart from the strutting and posturing of the cocks, I have witnessed no courtship ceremonials, and in spite of very close watching, not once has actual copulation been observed. (For an exceptional instance which seems difficult to explain, see note, 'October 11'). Copulation certainly does not appear to take place on the nest tree, and, as while the building is in progress the male never leaves the colony except for the purpose of procuring material and feeding, which he seems to do more or less simultaneously, it is unlikely that it takes place outside. From various little movements of the nest and sundry twitterings from within where a cock has followed a hen into the abode, it is my belief that copulation takes place inside the nest where the pair is not liable to be disturbed by the attention of the neighbouring cocks, which would surely be the case if a female exposed herself at this stage for any length of time amongst the band of males without. The cock takes no part in the incubation of the eggs.

The 'building mania' as it has been called, that comes over the adult cock at this season is a sure indication of his readiness to breed, and so long as he continues to build and complete nests, so long is the indication manifest that he is prepared to marry fresh wives. As soon as his first nest is completed and occupied by a hen, the cock takes up the building of a new nest. Leaving the entrance tube of his first nest a moderate length—a few inches—the cock forthwith selects a new twig, which need not necessarily be in the immediate neighbourhood of the first nest (see diagram of Control Colony on September 26) and proceeds to build a second. If he is strong and vigorous, and his instinct to breed sufficiently intense, he completes the second nest also. As soon as the egg chamber is ready or nearly so, the nest is taken possession of by another 'prospecting' female, of which there are several hanging about the colony as the season wears on, and the whole process is repeated till she is also safely on her eggs.

A strong suspicion of the existence of this state of affairs had already crossed my mind after I had had Colony No. 1 under observation for a few days. This colony was however a large one. The number of cocks and hens continually coming, going and hopping about was too unwieldy for adequate control, I could not obtain indubitable evidence here. Fortunately, shortly afterwards I came upon another small colony on a Palmyra palm containing six completed nests and three others at early 'Bell' stages. On each of these latter an adult cock was working, while, though the completed nests were occupied by hens who flew in and out, there were no other cocks in attendance. This was most interesting, and exactly what I had been looking for. I promptly set about trying to discover what the exact position here was. To this end, I drew a rough sketch plan of the colony ('Control Colony') marking the half-built nests and their respective cocks 1, 2 and 3, and the 6 complete nests a, b, c, d, e and f. I carefully noted down the behaviour of the cocks in relation to each of the completed nests. Next day I was again on the scene with a clean sheet of paper, made a fresh sketch plan of the colony and noted the movements of the cocks. This was repeated on two or three subsequent occasions,



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5. After weaving in his bunch of strips, the Cuckoo often perches a while on the dome as if for breath—



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6. and joins lustily in the frequent community choruses.

each time beginning afresh and quite independently and with a new sketch plan. The notes I had made (see Appendix 'September 25, 26, 27, 29') were then compared and scrutinized and it was found that my suspicions were well-founded. Each of the three cocks possessed two complete nests occupied by females, in addition to what he was then busy on.

Only one of these three cocks, however, had the breeding instinct of sufficient intensity to complete the third nest, which was in due course also occupied by a hen. In the other two instances, although females visited and inspected the nests on several occasions, the construction never advanced to a stage where they could be appropriated by them. Meantime the zeal of the cocks had begun to flag. They gradually lost interest in the new nests and some time later ceased work on them altogether and busied themselves with tinkering about with their already-completed nests in somewhat casual fashion. Although in this case the cock stopped all further building after the completion of his third nest, it is not difficult to conceive that given stronger stimulus he might have started on a fourth. Whether this would have been completed or not, would depend again upon the force of his building, i.e., breeding instinct.

Here, therefore, is the origin and explanation of the 'Cock Nest' theory which presupposed that the cock made these shelters by way of outlet for his super-abundant building energy and for his own special benefit, to serve as a protected perch for him to roost in. Not only is any such implication unwarranted by facts, but I have further ascertained (notes, September 30, October 1, 2 and 8) that at night the cocks do not roost in the nest-tree at all, but fly off long distances every evening to some common roost which I was unfortunately not able to locate. On a previous occasion in November, I came upon a patch of tall, coarse grass in Salsette where hundreds (they may have been a thousand!) of Bayas were roosting at dusk. The din of their chatter was audible a good three-quarters of a mile off. It was probably some common roost of this nature that was resorted to in this instance every evening by the cocks and unmated hens.

Coming now to the number of eggs laid by the Baya. In my experience, and that of numerous other observers, two to four eggs constitute a normal clutch. Where more than this number occur, it is generally conceded that they may be the product of two or more hens. According to my interpretation of the sexual relations of the Baya this laying by two or more females in a single nest is not difficult to account for. A female whose physiological 'ripeness' for egg-laying has been delayed through some cause or another, often arrives at a colony late in the season, to find that there is no nest available for her to occupy. She moves, and is chased about, from nest to nest until she comes upon one which already contains eggs, but is unattended. (The hens at this stage leave the nests to themselves for considerable periods during the heat of the day). She promptly enters and surreptitiously depositing her egg, is off again. Next day, she bides her opportunity and repeats the performance, and it is possible that owing to the paucity of laying sites, a third hen may also be driven to utilize this same nest.

Now, if my theory about the copulation taking place inside the nest holds, then I believe in a case like the above, it is possible that

a hen who has slipped in surreptitiously and probably without drawing the attention of the cock and thus gone untreaded by him, may lay eggs that are infertile. I suggest that a greater number of eggs than the maximum normal clutch of four, is found in nests chiefly at the end of the breeding season when no fresh building work is being done by the cocks, thus necessitating hitherto 'unpossessed' hens to resort to occupied nests. This was certainly the case in the only experience I have personally had in Sind of finding seven eggs in one nest. Most of the other nests in this colony contained chicks, and fresh building appeared to have been in abeyance for some time.

Further, while many observers have, time and again, found six to eight eggs in a nest, and in one case as many as eleven,¹ is it not significant that no one ever seems to have recorded more than four chicks in a Baya's nest? Though this is frankly pure speculation, and much more observation is needed on this point, does not the above lend colour to my suggestion that the extra eggs, over and above the maximum normal clutch (presumed to be the work of a second or third female) are infertile consequent upon the peculiar sexual relationship of the species?

My observations may be summarized as follows :—

1. The Baya is polygamous, not in the ordinary sense but in a manner of his own. The number of his wives depends upon the number of completed nests he is able to build for them, a factor dependent on his potency—in other words, on the force and intensity of his breeding instinct.
2. The hen takes no part in the building of the nest except 'interior decoration' at a late stage.
3. Incubation is carried out solely by the hen.
4. Feeding the chicks is done mainly by the hen. This instinct is also present in the cocks to a small extent, but is indulged in only late in the season after the building mania has run its course.
5. The 'Cocks' Nests' are nothing more than abortive attempts of the cocks, whose zeal for building has petered away while they are engaged on the work.

A remarkable thing which will be seen from my notes is the persistence with which a pair of White-throated Munias (*Uroloncha malabarica*) haunted Colony No. 1. That this was not just an exceptional coincidence is shown by my record on September 26 relating to Control Colony, where another pair was also observed behaving in a like manner. It was not unknown to me that this species occasionally lays in the disused nests of Bayas. I had on previous occasions, frequently observed pairs going in and out of old Baya nests, and on April 6, 1924, had actually taken four eggs from one into which a Munia had been noticed entering. Again, on visiting Baya Colony No. 1 on December 12 this year (1930), I discovered that one of the now deserted nests was occupied by a pair of Munias who flew in and out of the long entrance tube with perfect ease. This nest contained a brood of clamouring young, while a neighbouring nest was also tenanted by a second

¹'Nests and Eggs', Vol. II, p. 119.



7. All the builders flutter their wings and join in the choruses, in whatever position they happen to be at the time.



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8. Pilfering material from neighbouring nests is extensively practised by certain 'habitual offenders.'